An Optical Pumping Method for Measuring Quenching Rates of Excited Alkali Atoms

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A simple method based on optical pumping techniques has been used to measure the quenching rates of excited alkali atoms in various buffer gases. The rates of atomic excitation and fluorescent decay as a function of buffer gas pressure are measured by monitoring the transmitted and scattered beams, respectively. By periodically saturating the ground-state magnetic resonance transitions, differential changes in intensity can be observed by lock-in techniques, thereby eliminating the problem of instrumental scattering.

Results have been obtained for quenching of the first excited-state doublet of Rubidium by nitrogen. The quenching cross sections at room temperature for the $^2P_{1/2}$ and $^2P_{3/2}$ states are identical to within experimental error (5%) and equal to 80 Å^2. The rates for transfer between the doublet components have been observed and appear to be small, but no precise measurements have yet been made. For hydrogen and deuterium, preliminary work has shown that the rates for transfer between the components of the P doublet are comparable to the quenching rates out of them.

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